2622

03500.014786. PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#7
KD
11-6-03

In re Application of:)
: Examiner: Jason L. Sherrill
YUKITOSHI TAKEUCHI)
: Group Art Unit: 2622
Application No.: 09/659,841)
:
Filed: September 11, 2000)
:
For: IMAGE READING APPARATUS) October 2, 2003

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF SWORN TRANSLATION

Sir:

Applicant encloses a Declaration and Sworn Translation of Japanese Application No. 11-260587, which was filed September 14, 1999, from which the above-identified application claims priority. Applicant notes that the Office Action dated June 20, 2003 rejected Claims 1, 3, and 4 as obvious from U.S. Patent No. 6,464,416 (Aoshima) in view of U.S. Patent No. 6,108,108 (Peng). Since the Aoshima patent has an effective date of January 27, 2000, which is later than the September 14, 1999 filing date of the priority document, Applicant hereby request that the rejection based on the Aoshima patent be withdrawn.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

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DECLARATION

I, TAKAO OCHI, a Japanese Patent Attorney registered No. 10145, of Okabe International Patent Office at No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the priority documents of Japanese Patent Application No. 11-260587 filed on September 14, 1999 in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

signed this 24 day of September, 2003

TAKAO OCHI

PATENT OFFICE
JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: September 14, 1999

Application Number: Japanese Patent Application No. 11-260587

Applicant(s): CANON KABUSHIKI KAISHA

October 6, 2000

Commissioner,
Patent Office KOZO OIKAWA (Seal)

Certificate No. 2000-3082055

11-260587

[Name of the document] Patent Application

[Reference No.] 3852006

[Date] September 11, 1999

[Addressed to] Commissioner, Patent Office

[International Classification] H04N 1/04
H04N 1/04 105

[Title of the Invention] IMAGE READING APPARATUS

[Number of the Claims] 4

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[Name] JUNICHI WAKUTA

[Indication of Official Fee]

[Prepayment Ledger No.] 066073

[Amount] 21000

[List of Filed Materials]

[Material] Specification 1

[Material] Drawings 1

[Material] Abstract 1

[General Power of Attorney] 9703880

[Proof Requirement] Required

11-260587

[Name of the Document] Specification

[Title of the Invention] Image Reading Apparatus

[What is Claimed is]

[Claim 1]

An image reading apparatus for reading an image of an original by the use of image reading means through a light-transmitting member, comprising:

the image reading means for effecting scanning along a plane of the light-transmitting member;

a rope-like member for moving said image reading means; and

a rail member for guiding said image reading means,

wherein the posture of said image reading means is maintained by a tension of said rope-like member.

[Claim 2]

An image reading apparatus for reading an image of an original by the use of image reading means through a light-transmitting member, comprising:

the image reading means for effecting scanning along a plane of the light-transmitting member;

a rope-like member for moving said image reading means; and

a rail member for guiding said image reading means,

wherein a rotary moment in a surface which is parallel to the plane of the light-transmitting member is generated in the image reading means by a tension of said

rope-like member, and

said image reading means in which said rotary moment is generated is supported by a sliding portion sliding on said rail member.

[Claim 3]

An image reading apparatus according to Claim 2, wherein the tension of said rope-like member acts as a biasing force for biasing said image reading means to the light-transmitting member.

[Claim 4]

An image reading apparatus according to Claim 2 or 3, wherein said rail member is arranged to have a U-shaped cross section, and said sliding portion is a rotary member which is brought into contact with a U-shaped inner surface of said rail member by the rotary moment in the surface parallel to the plane of the light-transmitting member and rotationally moves on said rail member at a speed equivalent to a scanning speed of said image reading means.

[Detailed Description of the Invention]

[0001]

[Field of the Industrial Utilization]

This invention relates to an image reading apparatus for computer input, which reads an original such as a photograph or a document, converts it into digital data and outputs the digital data.

[0002]

[Prior Art]

The construction of a color image reading apparatus according to the prior art is schematically shown in Fig. 5 of the accompanying drawings.

[0003]

The letter P designates an original to be read, which is placed on an original mounting glass table 100, and a reading unit 101 is scanned in parallel to the original mounting glass table 100 to thereby read an image on the original.

[0004]

The reading unit 101, as schematically shown in Fig. 6 of the accompanying drawings, has incorporated therein LED's 101R, 101G and 101B of three colors which are light sources for irradiating the original, a rod lens array 101L for imaging the reflected light from the original on the light receiving element of an image sensor, and the image sensor 101S.

[0005]

The light sources of three colors are successively changed over and turned on and the image sensor 101S reads the reflected light of each color from the original, to thereby effect color resolution reading.

[0006]

The reading unit 101 is fixedly supported on a slider 102 slidable on a guide shaft 103 fixed to the main body of the apparatus. Also, a belt 104 for transmitting motive power from a motor 105 which is a scanning drive

source is fixed on the slider 102.

[0007]

By the forward and reverse rotations of the motor 105, the reading unit 101 can be reciprocally scanned within the range of the original mounting glass table 100.

[0008]

The constituents of the image reading apparatus further include an electrical equipment portion 106 comprising a control board and a power source, besides what has been described above.

[0009]

These constituents are disposed in a housing comprising a combination of an upper cover 112 for fixedly supporting the original mounting glass table 100 and a lower cover 113.

[0010]

An original cover 111 for pressing the original against the original mounting glass table 100 is openably and closably mounted on the original mounting glass table 100.

[0011]

Fig. 7 of the accompanying drawings is a read image data processing block diagram by this image reading apparatus. An image output signal read by the image sensor 101 in synchronism with the LED's turned on and off in succession is sent to an amplifier 121 and is amplified thereby, and thereafter is converted into a digital image

signal by an A/D converter 122.

[0012]

The A/D converter 122 divides the dynamic range of the image sensor (the reading output difference between the white portion and the black portion of original) into the bit number thereof, and allots the number of gradations in conformity with the brightness of the image on the original.

[0013]

For example, when an A/D converter of resolving power of 8 bits is used, white to black can be discriminated into 256 gradation levels, and when an A/D converter of resolving power of 10 bits is used, white to black can be discriminated into 1,024 gradation levels. Accordingly, in an image reading apparatus using the A/D converter of 8 bits, 24 bits = about 16,700,000 colors can be discriminated in the color reading by light sources of three colors R, G and B, and in the case of 10 bits, 30 bits = about 1,074,000,000 colors can be discriminated.

[0014]

There are several kinds of output forms of the image signal of the image reading apparatus, and depending on the use of an image read, an output form suited therefor can be selected.

[0015]

When a writing is to be read and the content thereof is to be applied to OCR or when a monochromatic line drawing

is to be read, a monochromatic binary image is suitable, and use is made of image data obtained by binarizing an image signal obtained with e.g. only G of the above-described light sources of R, G and B turned on, by a certain threshold value in an image processing circuit incorporated in a gate array 123.

[0016]

When an image is to be read with a view to read an image such as a photograph and output it to a monochromatic printer, use is made of image data binarized by the use of halftone processing such as a dither method or an error diffusing method using the image signal also by the G light source. When the processing of a color image is to be effected, image data of multiple values (24 bits, etc.) are suitable.

[0017]

The image signal passed via the image processing circuit is outputted to a computer 200 which is an apparatus such as a personal computer through an interface circuit 124.

[0018]

[Problems to be Solved by the Invention]

In recent years, however, the image reading apparatus according to the prior art as described above has come to be often used in offices and homes with the spread of personal computers. Along therewith, it has been brought to the fore as an important item in the

specification of products to make the installation area occupied on a desk and consumed electric power as small as possible.

[0019]

The pending problem when downsizing the apparatus is that since the span between the bearings of the reading unit 101 in the sub-scanning direction is short, vibration sometimes occurs to the movement of the reading unit 101 due to the fitting backlash between the bearings and the guide shaft 103. An image reading apparatus connected to a computer needs have the function of interruption/resuming the operation thereof in the course reading in conformity with the processing situation of the computer, and for the image before and after the interruption/resumption to be smoothly connected, there must not be such vibration.

[0020]

Also, a method of making consumed electric power small is to make the electric current supplied to the motor 105 small, and for that purpose, it is necessary to make the driving load of the motor 105 small.

[0021]

The present invention has been made to solve the above-mentioned problems of the prior art, and an object thereof is to provide an image reading apparatus which can reduce the size of the apparatus by preventing a vibration of image reading means and can reduce an electricity

consumption by decreasing a driving load.

[0022]

[Means for Solving the Problems]

In order to achieve the above object, according to the present invention, there is provided an image reading apparatus for reading an image of an original by the use of image reading means through a light-transmitting member, comprising: the image reading means for effecting scanning along a plane of the light-transmitting member; a rope-like member for moving the image reading means; and a rail member for guiding the image reading means, wherein the posture of the image reading means is maintained by a tension of the rope-like member.

[0023]

According to the present invention, there is also provided an image reading apparatus for reading an image of an original by the use of image reading means through a light-transmitting member, comprising: the image reading means for effecting scanning along a plane of the light-transmitting member; a rope-like member for moving the image reading means; and a rail member for guiding the image reading means, wherein a rotary moment in a surface which is parallel to the plane of the light-transmitting member is generated in the image reading means by a tension of the rope-like member, and the image reading means in which the rotary moment is generated is supported by a sliding portion sliding on the rail member.

[0024]

It is preferable that the tension of the rope-like member acts as a biasing force for biasing the image reading means to the light-transmitting member.

[0025]

It is preferable that the rail member is arranged to have a U-shaped cross section, and the sliding portion is a rotary member which is brought into contact with a U-shaped inner surface of the rail member by the rotary moment in the surface parallel to the plane of the light-transmitting member and rotationally moves on the rail member at a speed equivalent to a scanning speed of the image reading means.

[0026]

[Description of the Preferred Embodiments]

Some preferred embodiments of the present invention will hereinafter be described in detail by way of example with reference to the drawings. However, the dimensions, materials, shapes, relative disposition of constituent parts described in these embodiments, unless otherwise specifically described, are not intended to restrict the scope of this invention thereto.

[0027]

[First Embodiment]

A first embodiment will hereinafter be described with reference to Fig. 1 and Fig. 2. Fig. 1 and Fig. 2 show an example of the construction of an image reading

apparatus according to the first embodiment.

[0028]

The letter P designates an original to be read placed on an original mounting glass table 1, and a reading unit 2 as image reading means is scanned in parallel to the original mounting glass table 1 to thereby read an image on the original.

[0029]

The reading unit 2 has incorporated therein a light source for irradiating the original, a lens for imaging the reflected light from the original on the light receiving element of an image sensor, and the image sensor.

[0030]

The reference numeral 11 denotes a frame serving also as an outer package cover and having disposed therein the original mounting glass table 1 and the reading unit 2, and besides these, a rail 12 as a rail member for guiding the running of the reading unit 2, a control board, a power source, etc.

[0031]

Spacers 21 made of a material of high slidability such as POM are fixed to the opposite ends of the upper surface of the reading unit 2 in the main scanning direction thereof.

[0032]

Also, a support shaft 2a in the unit 2 is rotatably supported by an aperture portion 22a on a sensor holder

22, and the unit 2 is upwardly biased with the support shaft 2a as the center of rotation by a spring 23 fixed onto the holder 22.

[0033]

As the result, the spacers 21 contact with the back of the original mounting glass table 1, whereby the reading unit 2 scans the original while keeping the spacing between the surface of the original mounting glass table 1 and the light receiving surface of the image sensor constant.

[0034]

Also, the sensor holder 22 has slider portions 22b and 22c as sliding portions sliding relative to the rail 12. These slider portions 22b and 22c, like the spacers 21, are made of a material such as POM.

[0035]

Further, the sensor holder 22 has rotatably disposed thereon a transmitting mechanism for transmitting a driving force to the reading unit 2 and a pulse motor 31 which is a driving source, a gear train for decelerating the rotation thereof, a driving pulley 32 to which the rotation of the motor 31 is transmitted through the gear train, and an idle pulley 33.

[0036]

The reading unit 2 is connected to a control board on the main body of the apparatus by a cable, not shown, and the exchange of the electric power, the driving signal and an image signal is executed.

[0037]

A rail 12 for guiding the running of the reading unit 2 is fixedly placed in the frame 11.

[0038]

Also, one end 13a of a driving wire 13 as a rope-like member is fixed to the reading terminating end side. The driving wire 13 is twined on the driving pulley 32 on the reading unit 13, and is further passed over the idle pulley 33, and thereafter is fixed to the reading starting end side of the frame 11 through a spring 14.

[0039]

The driving wire 13 is passed over as described above, whereby the reading unit 2 receives a moment as indicated by arrow A, and thereby the slider portions 22b and 22c on the sensor holder 22 come into contact with the rail 12.

[0040]

The operation of the image reading apparatus constructed as described above will now be described with reference to Figs. 1 and 2.

[0041]

The reading unit 2 usually stands by at its home position on the reading starting end side during the non-operation thereof. When it receives a reading command from a computer connected thereto, the reading unit 2 starts scanning by the rotation of the motor 31, scans a white reference plate provided between the home position

and the original reading starting position of the apparatus and produces shading correction data, whereafter it effects the reading of the image on the original from the reading starting position.

[0042]

Here, the rotation of the motor 31 is decelerated through the gear train and is transmitted to the driving pulley 32. Usually, the step angle of the motor 31, the reduction ratio of the gears and the outer diameter of the driving pulley are determined so that the reading unit 2 may be moved by an amount corresponding to one sub-scanning line for a plurality of driving pulses given to the motor 31.

[0043]

When the motor 31 is rotated in a forward direction, the driving pulley 32 takes up the wire 13 with a result that the reading unit 2 is moved in the scanning direction.

[0044]

Also, when the motor 31 is rotated in a reverse direction, the reading unit 2 is moved toward its home position.

[0045]

As previously described, the reading unit 2 is always biased in the direction of arrow A due to the moment created by the tension applied to the wire 13, and the slider portions 22b and 22c contact with the rail 12, whereby the posture of the reading unit is maintained.

[0046]

That is, such a force that there is no backlash between the rail 12 and the sliding portion of the reading unit 2 and the sliding portion constantly contacts with the rail 12 is working and therefore, it is avoided that during the interruption/resumption of reading, vibration occurs to the movement of the reading unit 2.

[0047]

The above-mentioned moment can be minimized within a range in which the vibration of the reading unit 2 does not occur, by appropriately choosing the spacing B between the driving pulley 32 and the idle pulley 33 in the lengthwise direction of the reading unit.

[0048]

The basic portion of the driving system in the first embodiment is designated such that with respect to the reading direction in which feeding accuracy is necessary, the reading unit 2 draws in the wire 13 having one end thereof fixed and is moved thereby.

[0049]

Also, in the return direction, there is the possibility of more or less feeding irregularity occurring when the wire 13 is drawn in by the expansion and contraction thereof because the wire 13 is fixed to the apparatus through a tension spring, but feeding accuracy is not much required. Accordingly, the tension applied to the wire 13 may be small as compared with that in driving systems of

other types.

[0050]

As described above, in the present invention, the backlash between the bearings and the rail 12 which poses a problem when the bearing span of the reading unit 2 is short can be eliminated by the utilization of the tension applied to the wire 13. Accordingly, even if there is the interruption/resumption of the operation in the course of reading, a smoothly connected image can be obtained and the downsizing of the apparatus can be expedited.

[0051]

Also, as compared with the prior art system, the necessary driving load can be greatly reduced, and load sources heretofore individually required can be thrown into one and therefore, a reduction in consumed electric power becomes possible.

[0052]

Further, the reading unit 2 and the optical system are arranged very compactly, and this brings about the downsizing of the apparatus.

[0053]

[Second Embodiment]

A second embodiment is one in which the function of the spring for biasing the reading unit 2 toward the original mounting glass table 1 used in the first embodiment is also given to the tension applied to the driving wire 13, and brings about the effect of further

decreasing the driving load.

[0054]

The second embodiment will hereinafter be described with reference to Fig. 3. In Fig. 3, portions designated by the same reference numerals as those in the first embodiment are similar in construction and function to them.

[0055]

A bearing portion 2b is provided on the back of the reading unit 2 in the second embodiment, and instead of the spring 23 in the first embodiment, a rotatable roller 24 is mounted thereon.

[0056]

The roller 24 is disposed in the route of the driving wire 13, and is vertically in such a position that it depresses the driving wire 13 when the original mounting glass table 1 is mounted on the apparatus. Thus, the reading unit 2 is biased toward the original mounting glass table 1 by the tension of the driving wire 13 through the roller 24.

[0057]

An appropriate biasing force is obtained by suitably choosing the size of the roller 24.

[0058]

As in the first embodiment, the reading unit 2 is maintained in such a posture that the spacing between the surface of the original mounting glass table 1 and the light

receiving surface of the image sensor becomes constant by the spacers 21.

[0059]

According to the present construction, a similar effect can be obtained by a construction simpler than that of the first embodiment, accordingly in a form more simplified in assembly.

[0060]

[Third Embodiment]

A third embodiment intends to further reduce the driving load by eliminating the frictional load of the slider portions 22b and 22c with the rail 12.

[0061]

The third embodiment will hereinafter be described with reference to Fig. 4. In Fig. 4, portions designated by the same reference numerals as those in the first embodiment are similar in construction and function to them.

[0062]

A transmitting mechanism for transmitting a driving force to the reading unit 2, a pulse motor 31 which is a driving source, a gear train for decelerating the rotation thereof, a driving pulley 34 to which the rotation of the motor 31 is transmitted through the gear train, and an idle pulley 35 are rotatably disposed on the sensor holder 22 in the third embodiment.

[0063]

A U-shaped rail 15 for guiding the running of the reading unit 2 is fixed to and mounted in the frame 11.
[0064]

Also, one end 13a of the driving wire 13 is fixed to the reading terminated end side. The driving wire 13 is twined on the driving pulley 34 on the reading unit 2, and is further passed over an idle pulley 35, and thereafter is fixed to the reading starting end side of the apparatus frame 11 through a spring 14.
[0065]

The driving pulley 34 and the idle pulley 35 have cylindrical surfaces 34a and 35a as rotary members of the same diameter as the pitch circle diameter thereof (the diameter of the wire at the central position thereof) on the same shaft, and those cylindrical surfaces abut against the inner surface of the rail 15 by a moment created by tension being applied to the wire 13.
[0066]

In the reading operation, the reading unit 2 is always biased in the direction of arrow A by a moment created by the tension of the wire 13 applied to the driving pulley 34 and the idle pulley 35, and a posture in which the respective cylindrical surfaces are in contact with the inner surface of the rail 15 is maintained.
[0067]

That is, there is no backlash between the rail 15 and the sliding portion of the reading unit 2 and such a

force that the reading unit constantly contacts with the rail 15 is working and therefore, it is avoided that during the interruption/resumption of reading, vibration occurs to the movement of the reading unit 2.

[0068]

Also, the diameters of the cylindrical portions of the driving pulley 34 and the idle pulley 35 which contact with the rail 15 are equal to the pitch circle diameters of the pulleys 34 and 35.

[0069]

Accordingly, the peripheral speed given to the pulleys 34 and 35 by the wire 13 is equal to the peripheral speed at which the pulleys 34 and 35 roll on the rail 15. That is, the pulleys 34 and 35 do not slide but roll on the rail 15, and no frictional force is produced between the pulleys and the rail 15 and therefore, as compared with the sliding bearing heretofore used, the force necessary for driving can be decreased.

[0070]

The above-mentioned moment can be minimized within a range in which the vibration of the reading unit 2 does not occur, by appropriately choosing the spacing 13 between the driving pulley 34 and the idle pulley 35 in the lengthwise direction of the reading unit.

[0071]

While in the embodiments described hitherto, the driving wire is used as a rope-like member, the present

invention can likewise be carried out in a driving system using a timing belt.

[0072]

Also, the biasing utilizing the tension of the rope-like member is not restricted to the elimination of the backlash of the reading unit 2 and the biasing thereof toward the original mounting glass table 1, and can be applied to the absorption of any backlash and vibration occurring during scanning drive, irrespective of the type of the reading unit 2.

[0073]

[Effect of the Invention]

As described above, the present invention can prevent the fitting backlash between the image reading means and the rail member, and can further prevent vibration from occurring to the movement of the image reading means. Accordingly, even if the interruption/resumption of the operation occurs in the course of reading, a smoothly connected image can be obtained and the downsizing of the apparatus can be expedited.

[0074]

Also, the driving load necessary for the driving of the image reading means can be greatly reduced as compared with the prior-art system and therefore, consumed electric power can be made small.

[Brief Description of the Drawings]

[Figure 1]

Views for schematically showing the construction of an image reading apparatus according to the first embodiment of the present invention.

[Figure 2]

Enlarged views showing the image reading apparatus according to the first embodiment.

[Figure 3]

Enlarged views showing an image reading apparatus according to the second embodiment of the present invention.

[Figure 4]

Enlarged views showing an image reading apparatus according to the third embodiment of the present invention.

[Figure 5]

Views for schematically showing the construction of an image reading apparatus according to the prior art.

[Figure 6]

A view for schematically showing the construction of a reading unit.

[Figure 7]

A read image data processing block diagram showing the image reading apparatus.

[Description of Reference Numerals or Symbols]

1 … original mounting glass table

2 … reading unit

2a … support shaft

2b … bearing portion

11 … frame

12 … rail

13 … driving wire

14 … spring

15 … U-shaped rail

21 … spacers

22 … sensor holder

22a … aperture portion

22b, 22c … slider portions

23 … spring

24 … roller

31 … pulse motor

32 … driving pulley

33 … idle pulley

[Name of the Document] Abstract

[Abstract]

[Object]

An object of the present invention is to provide an image reading apparatus which can reduce the size of the apparatus by preventing a vibration of image reading means and can reduce an electricity consumption by decreasing a driving load.

[Means for Achieving the Object]

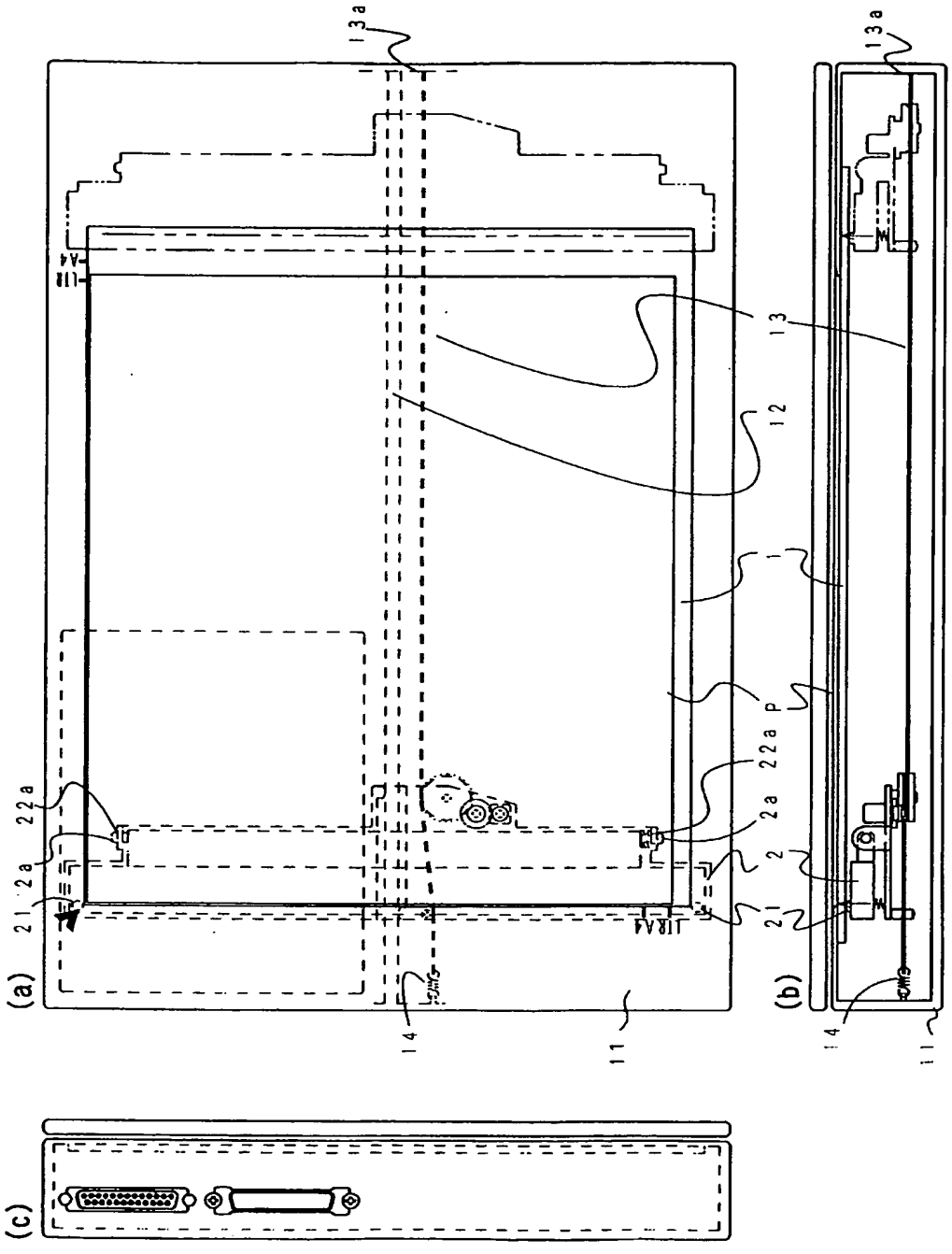
A reading unit 2 is all the time biased in the direction of arrow A due to a moment which is created by the tension applied to a wire 13, and the posture thereof is maintained since slider portions 22b and 22c are brought into contact with a rail 12. That is, such a force that there is no backlash between the rail 12 and the sliding portions of the reading unit 2 and the sliding portion constantly contacts with the rail 12 is working and therefore, it is avoided that during the interruption/resumption of reading, vibration occurs to the movement of the reading unit 2, whereby the downsizing of the apparatus can be expedited. Also, the driving load necessary for the driving of the image reading means can be greatly reduced as compared with the prior-art system and therefore, consumed electric power can be made small.

[Elected Drawing]

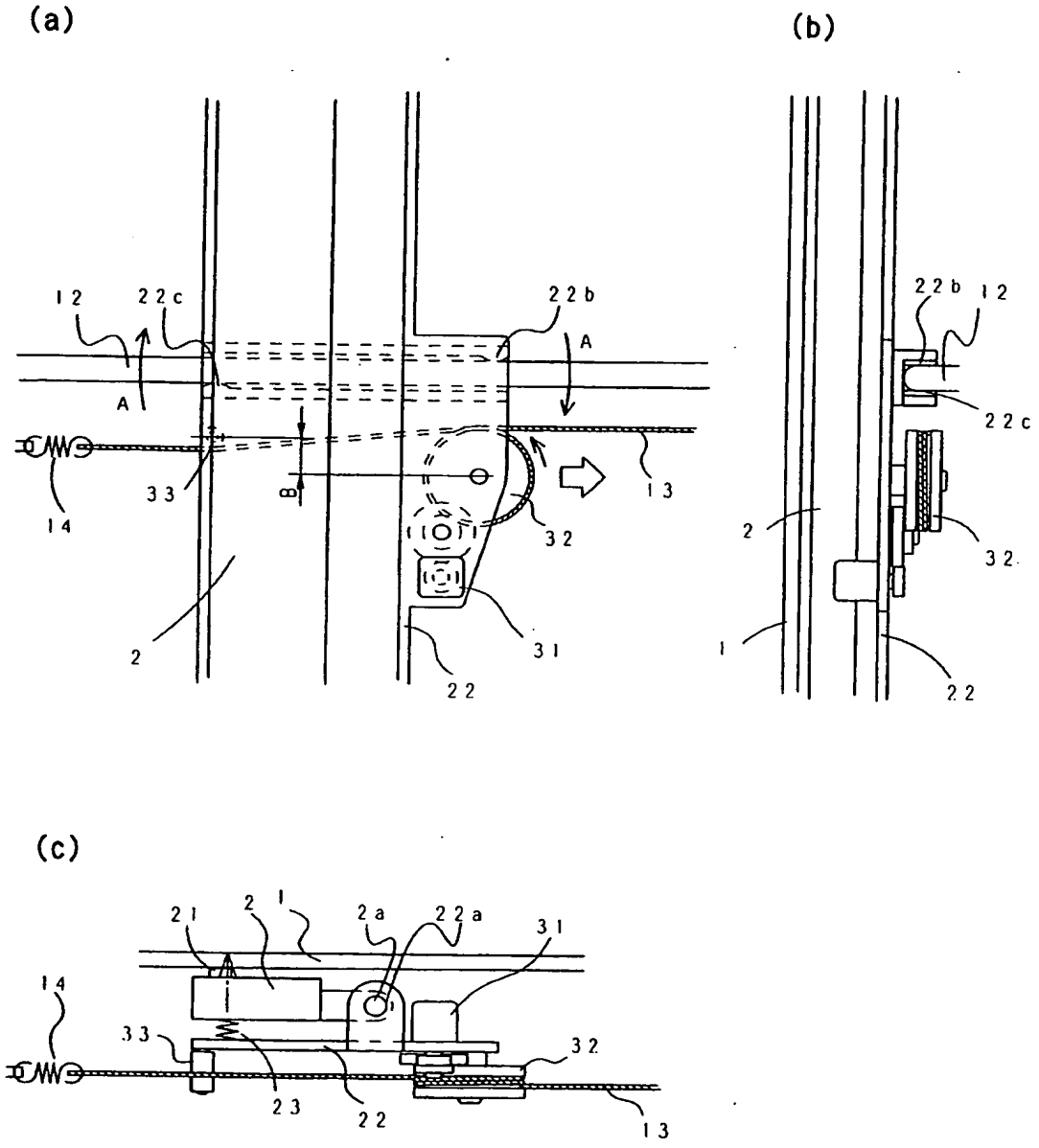
Figure 2

【書類名】　図面　[Name of the Document] Drawings

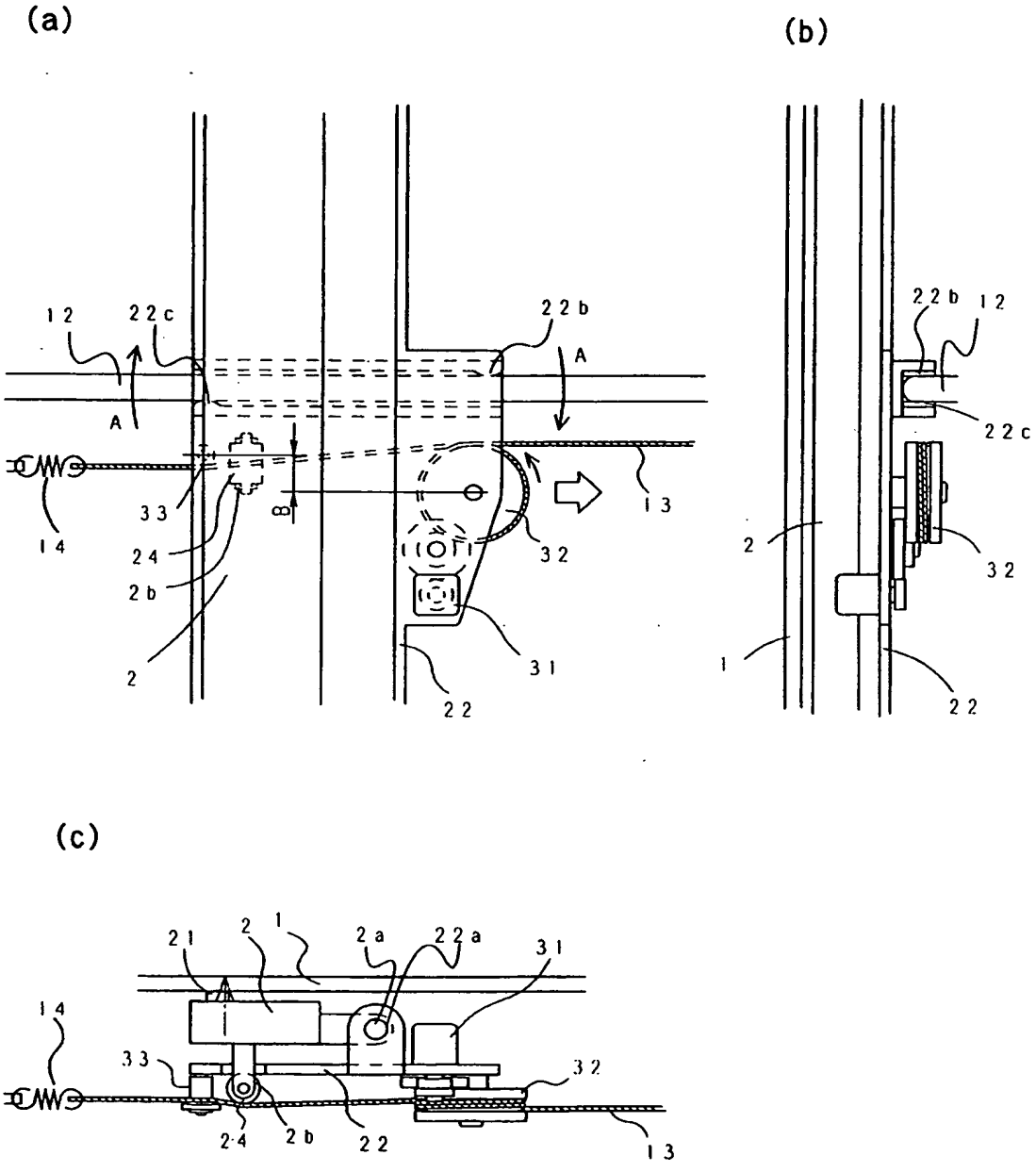
【図１】　Fig. 1



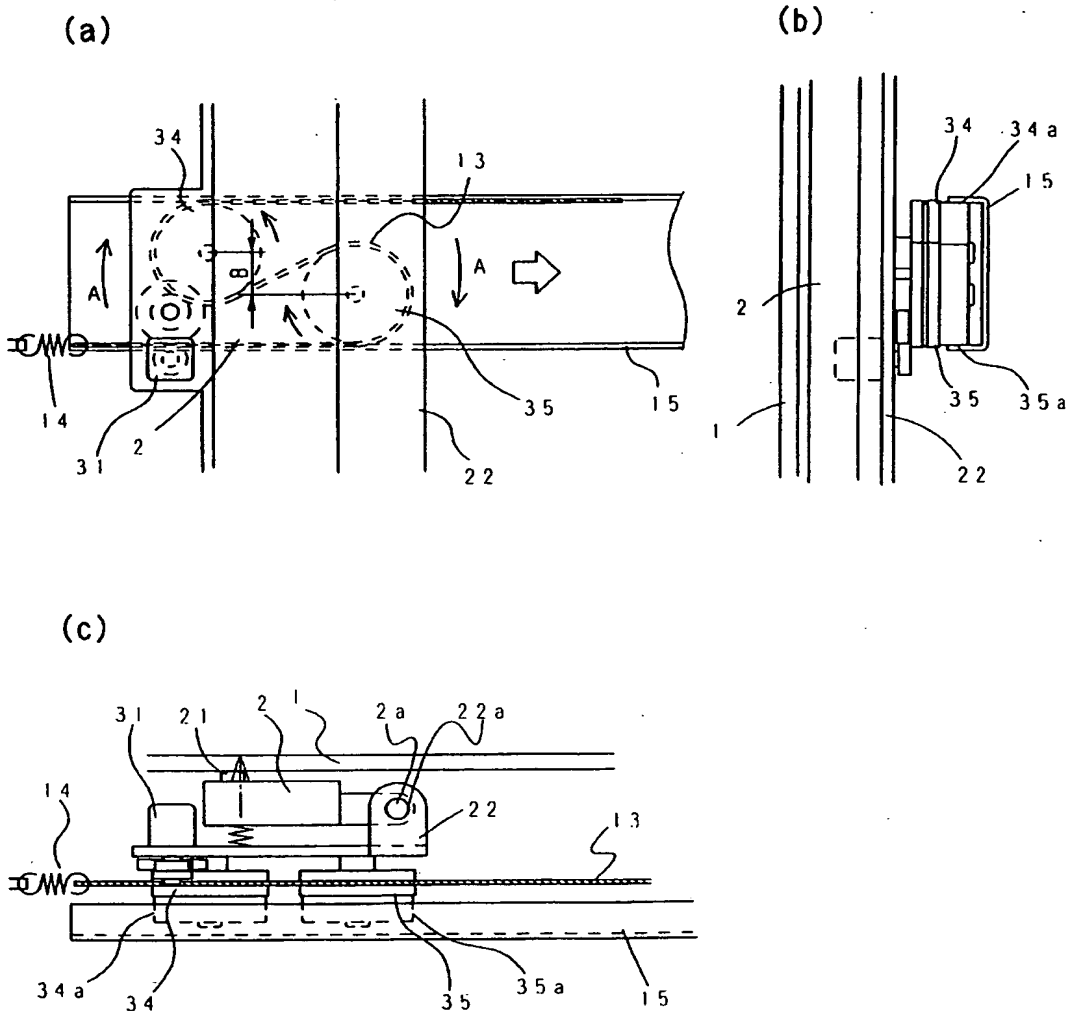
【図２】　Fig. 2


(a)
(b)
(c)
12
22c
22b
A
A
B
33
14
13
32
2
31
22
1
22b
12
22c
2
32
1
22
21
2
1
2a
22a
31
14
33
32
23
22
13

【図３】 Fig.3


(a)
(b)
(c)
12
22c
22b
A
A
13
14
33
24
2b
2
B
32
31
22
22b
12
22c
2
32
1
22
21
2
1
2a
22a
31
14
33
32
24
2b
22
13

【図４】　Fig. 4


(a)
34
13
A
A
B
14
31
2
35
15
22
(b)
34
34a
15
2
1
35
35a
22
(c)
31
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2a
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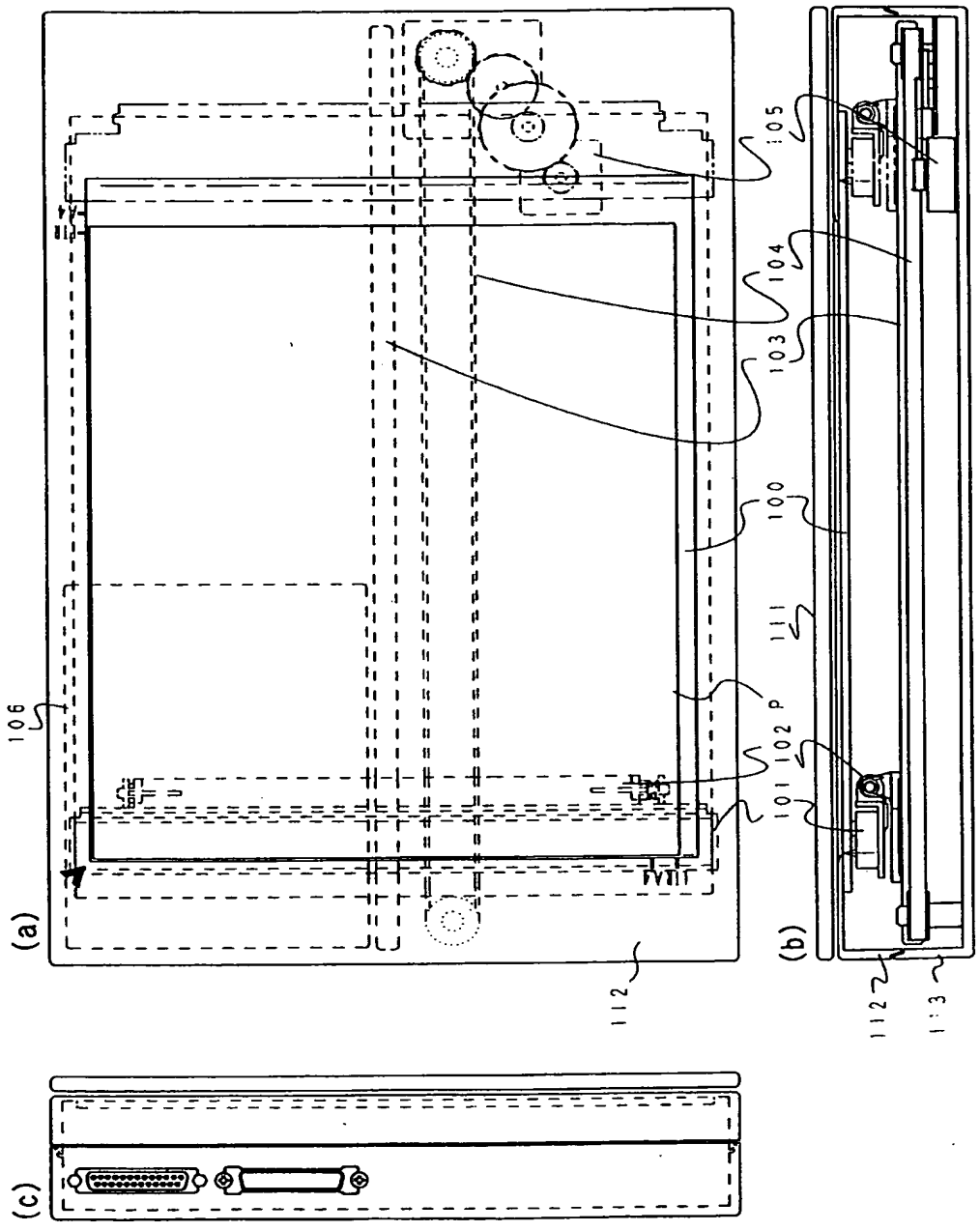
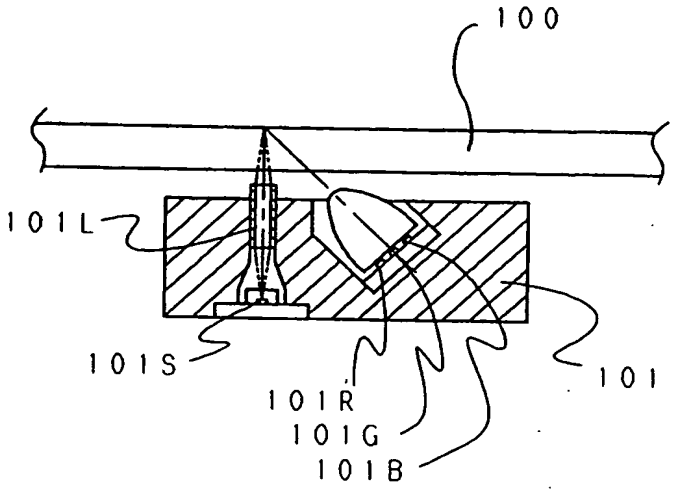
34a
34
35
35a
15

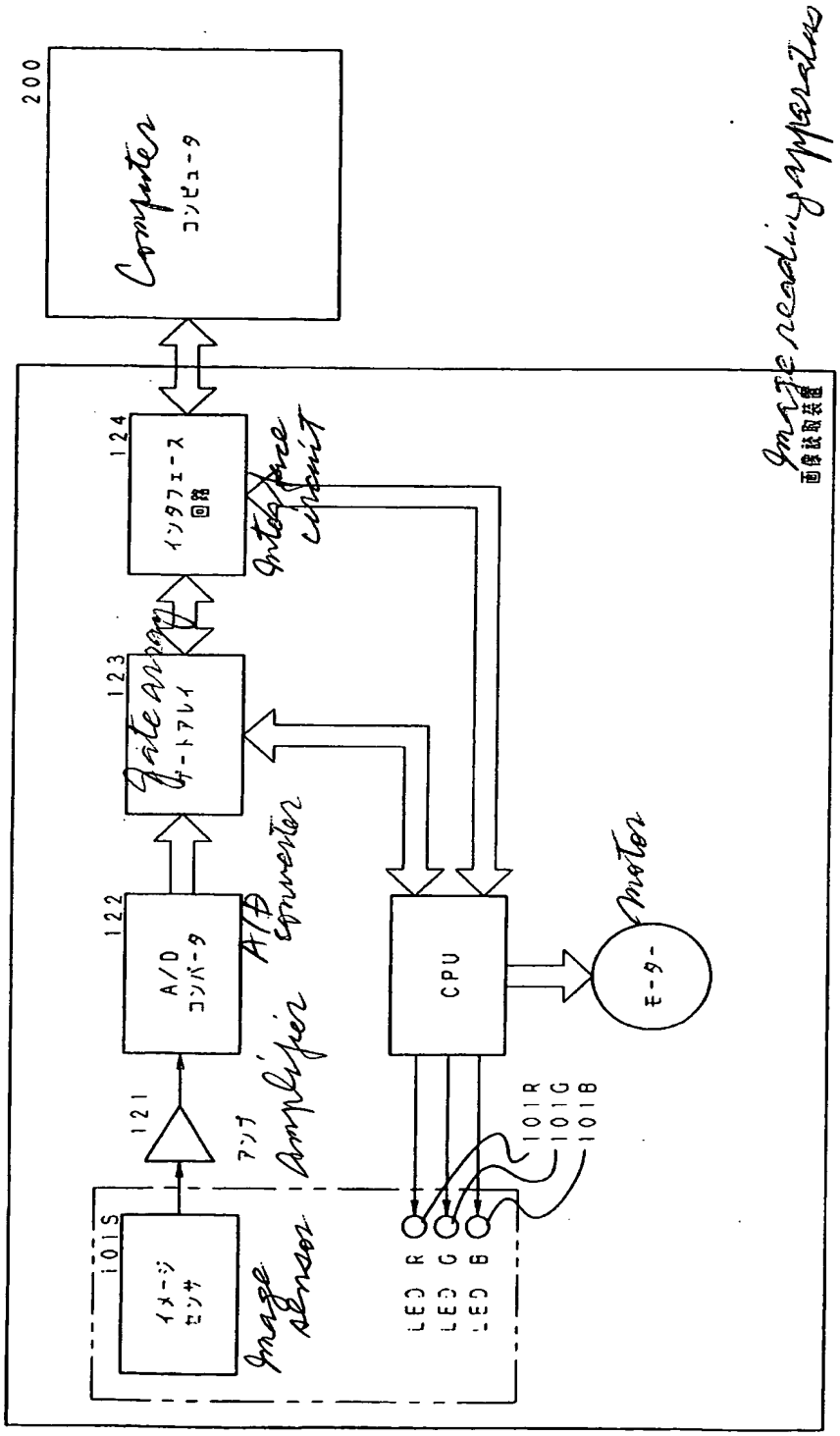
【図５】 Fig. 5



【図6】 Fig. 6



【図７】 Fig. 7


200
Computer
コンピュータ
Image reading apparatus
画像読取装置
124
インタフェース回路
Interface circuit
123
Gate Array
ゲートアレイ
122
A/D コンバータ
A/D converter
121
アンプ
Amplifier
101S
イメージセンサ
Image sensor
CPU
モータ
Motor
LED R
LED G
LED B
101R
101G
101B